Notes on the Pineapple Mealybug Complex, With Descriptions of Two New Species (Homoptera: Pseudococcidae)[1]

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INTRODUCTION

The pineapple mealybug, *Dysmicoccus brevipes* (Cockerell), is an important and widespread agricultural pest. In recent years it has become evident that this mealybug is but one of a group of closely similar forms which are apparently native to the New World. The purpose of this paper is to characterize this species complex, supplement available information dealing with previously described forms, and define and figure two recently discovered new species which belong here. Seven species are considered. Further collection and study of American mealybugs, particularly in the Neotropical region, will almost certainly uncover additional new species allied to the pineapple mealybug.

The adult male is known for only two of the species treated here. The male of one, *D. neobrevipes* Beardsley, has been described previously (Beardsley, 1961). The second male, that of *D. brevipes,* is described in this paper. Distinctive structural characters are found in the males of these two species, and it is not unreasonable to expect that similar differences will be found in males of other members of the complex when these are collected and studied.

The discovery of the male sex in *Dysmicoccus brevipes* is of considerable interest. In Hawaii, and apparently in certain other areas, this species occurs as an obligate parthenogenetic (thelytokous) race, and the existence of a bisexual race has only recently been demonstrated. In 1962, adults of both sexes, reared in laboratory cultures from the Ivory Coast of West Africa, were sent to me by Dr. Anselme Vilardebo of the Institut Français de Recherches Fruitieres Outre-Mer (I.F.A.C.) in Paris. Cytological examination of embryos from females from these cultures were made at my request by Gerald Robinson, Jr., at the Department of Genetics, University of California, Berkeley, and his findings have confirmed the bisexual nature of this race. Subsequently, Dr. Vilardebo has reared males from *D. brevipes* collections made in Madagascar, the Dominican Republic, and Martinique. The parthenogenetic race is known from Jamaica, West Africa,

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and Hawaii. Both parthenogenetic and bisexual races are probably widespread, although the latter has yet to be found in the Hawaiian Islands and probably is not present. The mode of reproduction of *D. brevipes* in many of the areas where this species occurs has not yet been recorded.

The relationship between the bisexual form of *D. brevipes* and the occurrence of pineapple wilt disease and "green spotting" of pineapple leaves merits further investigation. In Hawaii both *D. brevipes* and *D. neobrevipes* apparently transmit wilt, but only the latter causes green spotting. Carter (1949), in reporting on his observations on pineapple mealybugs in Brazil, stated that male cocoons were frequently observed in mealybug colonies on pineapple in that country, and that green spots were often present on leaves of infested plants. I have examined slide preparations of specimens which he collected during his Brazilian survey, and *D. brevipes* is the only species represented. This suggests that possibly the bisexual race of the pineapple mealybug may be capable of producing the green spotting symptom whereas the parthenogenetic race does not.

CHARACTERIZATION OF THE D. BREVIPES SPECIES COMPLEX

Females of the species here assigned to the *D. brevipes* complex possess the following combination of characters which will serve to separate them from other forms presently assigned to the genus *Dysmicoccus:*

Normally with 17 pairs of marginal cerarii, occasionally with but 15 or 16 pairs discernible in some specimens; anal lobe cerarii each with two conical setae plus several slender accessory setae; anterior cerarii normally with two or more conical setae, rarely more than 5 or 6, plus a few slender accessory setae. Ventral circulus present, extending across intersegmental line between abdominal segments 3 and 4.[2] Oral rim tubular ducts absent; tubular ducts of oral collar type present, confined largely to venter, occasionally a few on the dorsum. Multilocular disc pores confined to posterior part of venter. One or more small sievelike or indistinctly loculate discoidal pores usually present on margin of each eye, occasionally apparently absent on one or both sides in a few specimens of some species, or situated near to but not on margin of eye. Similar small discoidal pores present elsewhere on body, at least on dorsum of preanal abdominal segment and around the vulvar opening. Hind legs with micropores (small translucent spots) in upper surface of femora, tibiae, and sometimes coxae and trochanters.

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[2] In the present paper I have departed from the Ferris interpretation of abdominal segmentation in the Pseudococcidae. Ferris (1950) held that the basal abdominal segment is suppressed in this group and the first clearly distinguishable segment is morphologically the second, and he numbered the segments accordingly. Other workers (e.g. Theron, 1958) in dealing with the male sex, have not followed Ferris' interpretation of segmentation but have considered the first discernible segment to be morphologically the first as well. Because of the location of the posterior dorsal ostioles on the sixth discernible segment in both sexes, it is obvious that the same system of numbering the segments should be applied to males as well as females. Since there is no general agreement at present as to the correct morphological interpretation, the simplest solution seems to be to number the segments in sequence beginning with the first discernible one. By this system of numbering, the female vulva is situated intersegmentally between segments 7 and 8, the posterior dorsal ostioles on segment 6, and the anal lobe cerarii on segment 8.

Small discoidal pores of the type found in species assigned to the *D. brevipes* group occur also in certain other species presently placed in the genus *Dysmicoccus,* and in a few species now placed in other genera (e.g.: *Pseudococcus obscurus* Essig). In this connection, Prof. Howard McKenzie, of the University of California at Davis, very kindly examined specimens in collections at his disposal and made available for study examples of those species in which he noted the presence of discoidal pores. In addition to the species treated below, these pores were found in the following specimens identified by Prof. McKenzie: *Dysmicoccus desertorum* McKenzie, *D. difficilis* Lobdell, *D. merrilli* (Ferris), *D. obesus* (Lobdell), *D. pinicolus* McKenzie, and possibly in *D. salmonaceus* (Cockerell). With the exception of some examples of *D. obesus,* none of the above possessed discernible discoidal pores on the margins of the eyes.

Key to Species of Dysmicoccus Treated Here
(adult females)

1. Dorsum of 8th abdominal segment with a submedian group of setae considerably longer than those on anterior abdominal segments, 45–85 μ in length, on each side 2
   Dorsum without such a group of longer setae on 8th segment, dorsal setae all about 25 μ or less in length 3
2. Ventral setae relatively elongate, 65–100 μ in length, up to 120 μ in vulvar region. Multilocular disc pores more numerous, around 70–95; sometimes with a few small tubular ducts in lateral areas of dorsum ..... **2. morrisoni**
   Ventral setae relatively short, mostly 35 μ long or less, up to about 65 μ maximum in vulvar region; multilocular disc pores less numerous, around 30–50 normally present; dorsal tubular ducts never present ..... **1. brevipes**
3. Hind coxae each with 10–15 micropores on upper surface; hind tibiae each with a similar number of micropores ..... **6. mackenziei**
   Hind coxae without discernible micropores; hind tibiae with 30 or more micropores 4
4. Abdominal cerarii each with 2 conical setae 6
   Abdominal cerarii, except anal lobe pair, usually with more than 2 conical setae 5
5. Multilocular disc pores relatively few, 15 or fewer in available specimens; antennae 6- or 7-segmented ..... **4. probrevipes**
   Multilocular disc pores more numerous, around 30–70 present; antennae 8-segmented ..... **3. neobrevipes**
6. Ventral body setae relatively elongate, up to 75 μ or more in length; multilocular disc pores more numerous, total around 180 or more ..... **7. alazon**
   Ventral body setae shorter, about 50 μ maximum length (except on venter of head); multilocular pores less numerous, total around 110 or fewer ..... **5. bispinosus**

1. Dysmicoccus brevipes (Cockerell).

Dactylopius brevipes Cockerell, 1893, THE ENTOMOLOGIST 26:177.
Pseudococcus brevipes, Ferris, 1948, *In* Zimmerman, INSECTS OF HAWAII 5:189, fig. 105.
Dysmicoccus brevipes, Ferris, 1950, ATLAS, SCALE INSECTS NORTH AMERICA 5:59, fig. 19.—Balachowsky, 1957, REV. DE PATH. VEG. ET D'ENT. 36(4): 188, fig.—Beardsley, 1959, PROC. HAW. ENT. SOC. 17(1):29.
Dysmicoccus pseudobrevipes Mamet, 1941, BULL. ENT. RESEARCH 32(1):58; 1957, MEM. INST. SCI. MADAGASCAR, Ser. E. 8:367. New Synonymy.

The adult female of the pineapple mealybug has been redescribed in detail by Balachowsky (1957).

The placing of Mamet's *D. pseudobrevipes* in synonymy is the result of my examination of two specimens, determined as *pseudobrevipes* and compared with his type by Mamet. These specimens are labeled: Mauritius (Lechzio), on sugar cane rooted seedling, Col. L. A. Moutia. The slide bearing these specimens was sent by Mamet to Professor McKenzie for study, and was examined by me at Davis, California in December, 1964.

Adult Male. Length of body about 1.0 mm.; available specimens all macropterous. Antennae 8-segmented, about 540 μ long; individual segments from scape outward measuring 45: 60: 90: 72: 63: 69: 66: 75 μ long respectively. Antennae clothed with slender filamentous setae about 45 μ maximum length, and short, fleshy, clavate setae, about 8–10 μ in length (fig. 1,A); filamentous setae slightly more numerous than clavate type, particularly on apical segment. Elongate digitiform sensory setae present on three distal segments, 4 or 5 on segment 8, 1 or 2 each on segments 6 and 7, these about 33 μ maximum length. Head without a well-developed dorso-medial sclerite; with a moderately well defined mid-cranial ridge extending dorsally to a point between dorsal eyes. Venter of head largely membranous except for sclerotized area between eye sockets. Eyes moderately large, dorsal pair each about 32 μ diameter, ventral pair each about 45 μ diameter.

Dermal discs, about 6 μ diameter, mostly with 4 peripheral loculi, occasionally with 3 such loculi, distributed along sides of abdomen; a group of 4–6 on each side of dorsum of abdominal segment 7, 6–8 each side abdominal segment 1, 1 or 2 on each side of each of several other abdominal segments; 4–6 ventrally on membranous part of mesothorax behind mesosternal sclerite; 1–3 in membranous area behind each anterior spiracle; 4–6 laterally on each side of prothorax, 2–4 on venter of prothorax between front coxae, 1 or 2 each side anterior part of head between bases of antennae. Tail-forming pore clusters restricted to pair on 8th abdominal segment; each composed of around 40 stellate pores about 4.5 μ diameter. Dorsum and venter sparsely clothed with slender filamentous setae mostly 18–24 μ long; membranous parts of head, thorax, and 2 basal abdominal segments bearing small fleshy clavate setae of the type occurring on antennae, in addition to filamentous setae.

Penial sheath (fig. 1,C) about 150 μ long; without discernible median lobes; posterior extension tapering to a blunt, nearly truncate apex about 18 μ wide at

9 μ before tip. Aedeagus (fig. 1,C) bifid at apex, the cleft extending inward about 20 μ from tip; width at base of cleft about 8–9 μ.

Legs of moderate length; hind femora about 200 μ long; clothed with slender filamentous setae about 25 μ maximum length, plus short fleshy clavate setae of the type occurring on antennae; the latter slightly less numerous than the former. Hind tarsal claws 37 μ long.

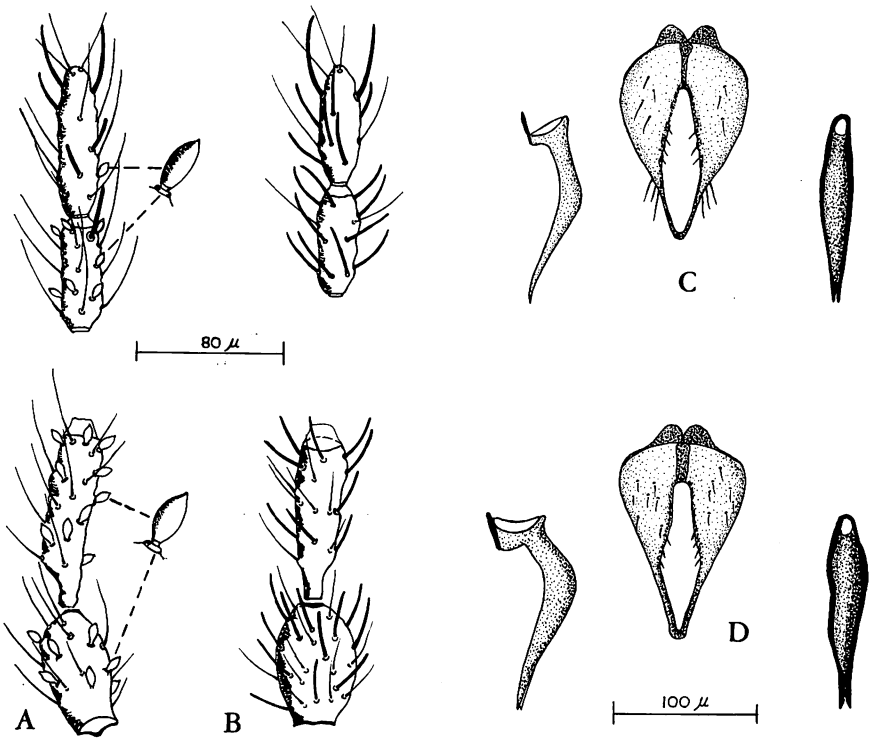

FIGURE 1. A, antenna of *Dysmicoccus brevipes,* male: from bottom to top, segments 2–3; 7–8; B, antennae of *D. neobrevipes* Beardsley, male: from bottom to top, segments 2–3; 9–10; C, genitalia of *D. brevipes,* male: center, ventral aspect of penial sheath; left, lateral aspect; right, ventral aspect of aedeagus; D, genitalia of male *D. neobrevipes.*

Abdominal sclerotization consisting of a broad transverse patch on dorsum of segment 8; a small sublateral patch on each side of venter of segment 8 near base of penial sheath, a small sublateral patch on each side of venter of segment 7. A pair of intersegmental transverse patches on dorsum between segments 1 and 2, these often confluent middorsally; and a pair of smaller dorsal intersegmental patches between segments 2 and 3. Posterior dorsal ostioles large and well defined.

Described from 4 slide-mounted specimens: Anarex Plantation, Ivory Coast, Africa, reared ex pineapple, A. Vilardebo, collector, received February 1962. Additional slide-mounted specimens have also been examined from the same source, received October, 1963; from Dominican Republic, Jan. 25, 1964, reared ex pineapple by A. Vilardebo; from I.F.A.C. Station near Tamatave, Madagascar, May 1964, reared ex pineapple by A. Vilardebo; and from Pre Vert Zone, Martinique, French West Indies, March 1964, reared ex pineapple by A. Vilardebo.

Males of *D. brevipes* are readily distinguishable from those of *D. neobrevipes* (the only other member of this species-group for which males are known) by the possession of 8-segmented antennae (vs. 10-segmented in *D. neobrevipes*), and by the unusual, short, clavate setae which occur on the body and appendages in place of the usual digitiform type of setae found on males of *D. neobrevipes* and most other male pseudococcids. I know of no other mealybug male which possesses this type of setae.

The structure of the penial sheath and aedeagus of *D. brevipes* males is similar to that of *D. neobrevipes*. The aedeagus is a little broader (11–12 μ wide at base of apical cleft) and the cleft a little deeper (around 26 μ) in *D. neobrevipes* males (fig. 1,D).

The adult female of the pineapple mealybug has been redescribed in detail by Balachowsky (1957). The females associated with the males described above were morphologically indistinguishable from *D. brevipes* females from the Hawaiian Islands. So far as is known, *D. brevipes* reproduces exclusively by parthenogenesis in Hawaii, and males are unknown there.

2. Dysmicoccus morrisoni (Hollinger).

Pseudococcus morrisoni Hollinger, 1923, MISSOURI AGRIC. EXPT. STA. RESEARCH BULL. 58: 55.

Dysmicoccus morrisoni, Ferris, 1950, ATLAS OF SCALE INSECTS NO. AMERICA 5:67, fig. 23.

Two specimens which apparently are a part of Hollinger's type material from Missouri, plus a few additional specimens determined as *morrisoni* by Professor Ferris (two from Coytesville, New Jersey, and one from Saratoga Springs, New York, all ex *Hicoria*), have been available for study.

D. morrisoni resembles *D. brevipes* more closely than do any of the other forms considered here. Ferris (1950:67) states that *morrisoni* "is so close to *brevipes* that were it not for biological evidence it would not here be recognized." In his key to North American *Dysmicoccus,* Ferris separates these two species on the basis of the presence in *morrisoni* of a few scattered small tubular ducts on the lateral portions of the dorsum. Such ducts are present in specimens which I have examined from New York and New Jersey, but are not discernible, even after restaining, in the two specimens from Hollinger's Missouri material. The absence of these dorsal ducts in some specimens assigned to *morrisoni* also was noted by Ferris.

In spite of the general similarity of these two species, the specimens which I have examined exhibit several slight, but apparently consistent differences which

seem to offer good morphological grounds for their separation. Both *brevipes* and *morrisoni* have the dorsal setae of the 8th abdominal segment relatively elongate. However, this feature is considerably more pronounced in *brevipes,* where dorsal setae anterior to those of abdominal segment 7 are only one-fourth to one-third the length of those on segment 8. In *morrisoni,* setae of the dorsum of anterior abdominal segments are one-half to two-thirds the length of those on segment 8. In the *D. morrisoni* specimens examined, the ventral body setae are relatively much more elongate than are those of *D. brevipes.* In the former the ventral setae of the posterior abdominal segments around the vulva range to about 120 μ maximum length, the cisanal and obanal setae near the posterior apex (see Ezzat and McConnell, 1956) are each around 120 to 140 μ long, and many of the setae on the mid-ventral areas of the body range between 65 and 100 μ in length. In *brevipes* the ventral setae around the vulva range to about 65 μ maximum length, the cisanal setae about 80 μ maximum, the obanal about 50 μ maximum, and the setae of the mid-ventral region are all about 35 μ long or less.

The *D. morrisoni* specimens examined possess more numerous multilocular disc pores than do those of *D. brevipes.* The two specimens from Hollinger's material have 74 and 70 multilocular pores respectively, and the number of these pores range from 80 to 95 in the three other available specimens. The number of multilocular pores in available *D. brevipes* specimens range between 28 and 50. The shape of the ventral sclerotized area of the anal lobes is similar in both species, although it appears to be a trifle more elongate in *morrisoni* than in *brevipes.*

In both the specimens of Hollinger's material which were examined, there are but 16 pairs of discernible marginal cerarii, one pair on the lateral part of head having been lost in both cases. However, Hollinger's description indicates that there were 17 pairs in the majority of the specimens which he studied.

The material from the Hollinger collection is labeled simply "*Pseudococcus morrisoni* sp. novo." and "Hickoria alba." There are 3 slides bearing this label, each with a single specimen, in the U.S. National Museum collection. They are part of a lot of slides sent by Hollinger to Professor Ferris, and later by Ferris to Dr. Harold Morrison for incorporation into the national collection. Correspondence between Ferris and Morrison, in the latter's files in Washington, indicates that the specimens in this collection should be regarded as cotypes of Hollinger's species. Of the three specimens, I have stained and remounted the best two for study.

Whether or not Hollinger designated holotypes of his species is not known. Additional specimens from his type material may exist, most probably at the College of Agriculture in Columbia, Missouri. For this reason I have refrained from designating a lectotype for *D. morrisoni* at this time.

3. Dysmicoccus neobrevipes Beardsley.

Dysmicoccus neobrevipes Beardsley, 1959, PROC. HAW. ENT. SOC. 17(1):31, figs. 1, 2; 1960, PROC. HAW. ENT. SOC. 17(2):217, fig. 2,F (male).

This species was described from Hawaiian material. Subsequently I have

seen specimens from the following extra-Hawaiian localities: Gilbert Is., Tarawa: Aug. 1956, E. S. Brown, on banana; Bairiki, Nov. 1957, N.L.H. Krauss, on *Guettarda.* Mariana Is., Guam: Agana Swamp, June 1936, O. H. Swezey on *Cresentia alata* fruit; Feb. 1938, R. G. Oakley, on tuberose; Mar. 1938, R. G. Oakley, on *Barringtonia speciosa;* Dec. 1953, O. N. Liming, on *Pipturus argentea.* Rota: Angiano, June 1946, R. G. Oakley, on *Theobroma cacao;* June 1946, H. Townes, on *Agave sisalana.* Fiji Is.: in quarantine at Seattle, Washington, Mar. 1962, on *Musa paradisiaca sapientum.* Philippine Is.: in quarantine at Honolulu, July 1961, on *Annona reticulata;* in quarantine at Honolulu, Mar. 1963, on *Garcinia mangostana;* Los Baños, Laguna, July 1964, Krauss, on custard apple fruit; Davao, Mindanao, May 1964, Krauss, on *Achras zapota* fruit. Jamaica, B.W.I.: Kingston, June 1962, S. W. Brown, on *Piscidia piscipula.* Mexico: in quarantine at Winterhaven, California, Mar. 1963, on coconut caps.

As noted previously, the male of this species is quite distinct from that of *D. brevipes* (fig. 1,B,D).

4. **Dysmicoccus probrevipes** (Morrison), new combination.

Pseudococcus probrevipes Morrison, 1929, ANN. ENT. SOC. AMERICA 23(1): 37, fig. 1.

A paratype slide containing two somewhat fragmentary specimens was loaned for study by the U.S. National Museum. A specimen from their collection labeled: Columbia, at New York (in quarantine) Mar. 1937, McMasters, coll. on pineapple, N.Y. no. 69637, appears to belong here.

D. probrevipes is close to *D. neobrevipes* but may be distinguished by the possession of fewer multilocular disc pores (around 15 in available specimens), 6- or 7-segmented rather than 8-segmented antennae, and shorter legs. The male of this species is unknown.

5. **Dysmicoccus bispinosus,** new species (fig. 2).

Female. Size moderate, length of slide-mounted specimens 2–2.5 mm. Body moderately broadly oval; anal lobes moderately protuberant. Antennae 8-segmented, about 435 μ long. Legs moderately robust; hind femora about 255 μ long by about 109 μ maximum width; hind tibiae about 224 μ long; hind tarsi about 96 μ long; hind tarsal claw about 32 μ long. Hind coxae, trochanters, and tarsi without discernible micropores; hind femora each with about 100 and hind tibiae each with about 65 micropores, distributed on upper surface as indicated in figure. Labium about 205 μ long. Anal ring cellular, about 96 μ wide, bearing 6 setae about 110 μ maximum length. Two pairs prominent dorsal ostioles present, their lips weakly sclerotized. Circulus present, well developed, about 55 μ wide, extending across fold between abdominal segments 3 and 4. Eyes well developed, about 38 μ diameter, without a differentiated basal cone; with one to three small paraocular discoidal pores on margin of each.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 22 μ maximum length, 4–5 slender accessory setae 18–35 μ long, plus a concentration of around 35 trilocular pores, borne on a moderately well-defined

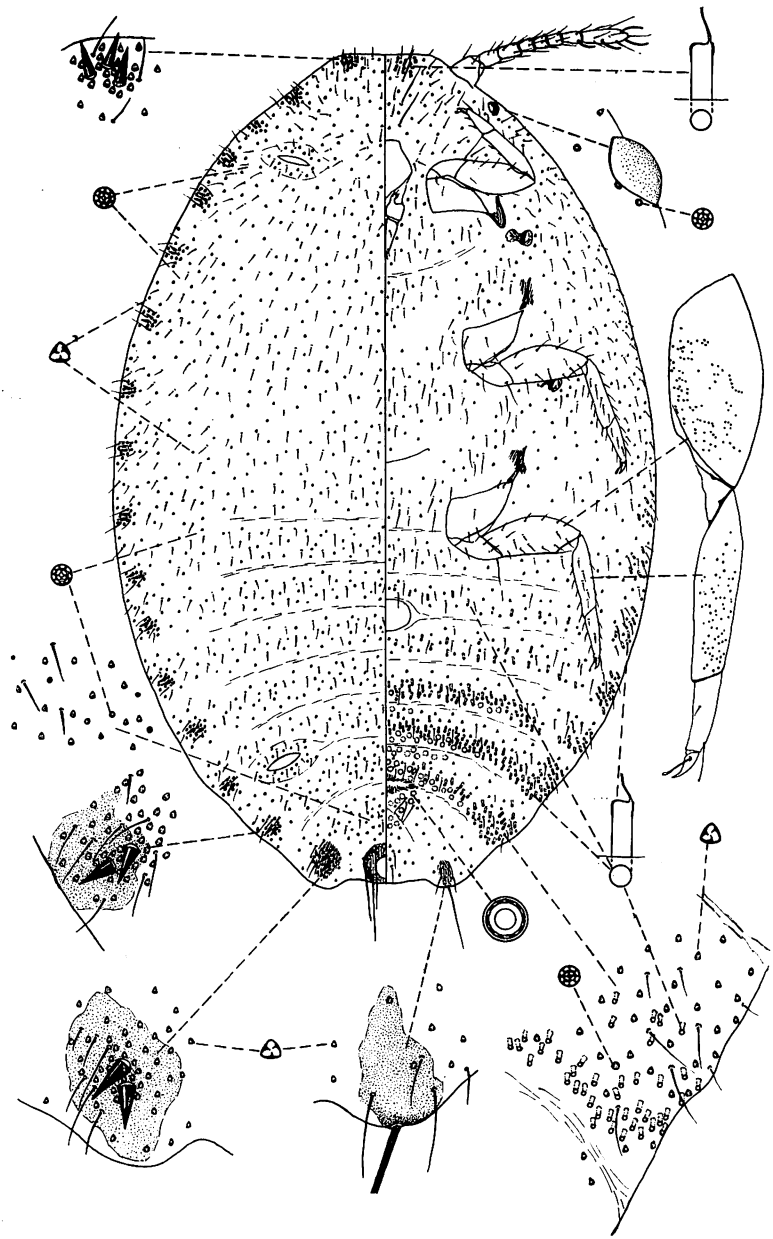

FIGURE 2. *Dysmicoccus bispinosus,* new species, dorsal and ventral aspects, and details.

sclerotized area. Penultimate cerarii each with 2 conical setae about 20–21 μ maximum length, 4–6 slender accessory setae 15–30 μ long, and a concentration of trilocular pores; surrounding derm weakly sclerotized. Anterior abdominal cerarii with two conical setae around 19 μ maximum length, those of thorax and head with two or occasionally three such setae, plus several slender accessory setae and a slight concentration of trilocular pores.

Venter of anal lobes each with an elongate, weakly sclerotized area about twice as long as its maximum width or less. Anal lobe seta about 175 μ long.

Dorsum without tubular ducts; moderately densely set with trilocular pores, interspersed with small circular discoidal pores mostly about 3 μ diameter, these somewhat less numerous than trilocular pores. Venter with numerous small oral collar ducts 2–3 μ diameter, distributed in transverse bands across posterior margin of abdominal segments 5–7; similarly but less abundantly distributed on segments 3–4; a few laterally on venter of segments 1 and 2; and on anterior margin of head between antennae. Around 70–100 multilocular disc pores of the usual pseudococcid type present on posterior part of abdominal venter, around vulva, on anterior margin of segment 7, on anterior and posterior margins of segment 6, and along posterior margin of segment 5. Ventral derm moderately densely set with trilocular pores, interspersed with discoidal pores about 3 μ diameter; the latter less numerous than trilocular pores.

Dorsum sparsely clothed with short spiniform setae about 16 μ maximum length; ventral setae longer and more slender, 13–44 μ long; longer setae on venter of head anterior to mouthparts about 60 μ maximum length.

Male. Unknown.

Described from 10 slide-mounted specimens. Holotype and 9 paratypes, on 9 slides: 5 mi. E. Temascal, Oaxaca, Mexico, 14–XI-193, D. H. Janzen collector, ex *Acacia cornigera,* with ants. Holotype in collection of University of California, Davis; paratypes at Davis; Univ. of Hawaii, Honolulu; U.S. National Museum, Washington, D.C.; and State Dept. Agriculture, Sacramento, California.

D. bispinosus seems closely allied to *D. neobrevipes.* It differs from the latter in having but two conical setae on each of the abdominal cerarii; and in possessing considerably more ventral tubular ducts. In *bispinosus* the multilocular disc pores are somewhat more numerous (about 70–100) than in *neobrevipes* (30–70), and are present on segment 5 where they are generally absent in *neobrevipes. D. bispinosus* also resembles *D. alazon* Williams in some respects (e.g., in having two conical setae on each abdominal cerarius instead of 3 or more), but the latter possesses longer legs and antennae, more numerous multilocular disc pores, and more elongate ventral setae.

A single, adult female specimen in poor condition is at hand from Mexico, taken in quarantine at Nogales, on pineapple, which is generally similar to *bispinosus* but differs in having somewhat more numerous tubular ducts along lateral margins of venter, more numerous multilocular disc pores, and longer legs. This specimen apparently represents an undescribed form allied to *bispinosus,* but the condition of the specimen will not permit description at this time.

6. **Dysmicoccus mackenziei,** new species (fig. 3).[3]

Female. Size moderate, length of slide-mounted specimens 2.0–2.3 mm. Body moderately broadly oval; anal lobes moderately protuberant. Antennae 8-segmented, about 350 μ long. Legs moderately short; hind femora about 185 μ long by about 60 μ maximum width; hind tibiae about 145 μ long; hind tarsi about 92 μ long; hind tarsal claw about 25 μ long. Hind coxae each with around 10–20 translucent spots or micropores on upper surface; hind trochanters each with a few such micropores discernible along posterior margin, 4–6 in holotype, fewer in some paratypes, sometimes apparently wanting; hind femora each with 9–15 micropores distributed along posterior margin on upper surface; hind tibiae each with 10–15 such micropores distributed on upper surface as indicated in figure. Labium about 160 μ long. Anal ring cellular, about 72 μ wide, bearing 6 setae about 115 μ maximum length. Two pairs well-developed dorsal ostioles present, their lips weakly sclerotized. Circulus well developed, about 90 μ wide, extending across fold between abdominal segments 3 and 4. Eyes well developed, about 27 μ diameter, without a differentiated basal cone; 1–3 paraocular discoidal pores on margin of each eye.

With 17 pairs of marginal cerarii. Anal lobe cerarii each with 2 conical setae about 25 μ maximum length, 5–6 slender accessory setae about 35 μ maximum length, plus a concentration of around 35–50 trilocular pores, borne on a moderately well-defined sclerotized area. Penultimate cerarii each with 3–5 conical setae of various sizes, the largest about 22 μ long; 2–3 slender accessory setae about 27 μ maximum length, and a concentration of around 30–40 trilocular pores, borne on a weak, poorly defined sclerotized area. Anterior abdominal, thoracic, and cephalic cerarii mostly with 3–4 conical setae about 16 μ long or less, plus 2–3 slender accessory setae 22 μ long or less, and a concentration of around 10–20 trilocular pores. Some cerarii, particularly on head and thorax with but 2 conical setae, or occasionally with but a single such seta; derm surrounding anterior cerarii unsclerotized, or sometimes slightly sclerotized between bases of conical setae.

Venter of anal lobes each with a well-defined sclerotized patch about 40 μ in length, and slightly narrower than long. Anal lobe seta about 145 μ long.

Dorsum without tubular ducts; moderately densely set with trilocular pores interspersed with small circular discoidal pores 3–4 μ diameter; latter considerably less numerous than trilocular pores. Tubular ducts of oral collar type confined largely to venter of abdominal segments 5–7; these of two distinct sizes, the larger 6–7 μ diameter and the smaller 3–4 μ diameter; 2 or 3 larger ducts plus 2 or 3 smaller ducts grouped near lateral margin on segments 6 and 7; 1 or 2 larger ducts on each side of segment 5, and 1 or 2 beneath each interantennal cerarius on head; smaller ducts present in transverse rows of 10–20 across venter of abdominal segments 5 and 6. Multilocular disc pores confined to venter of posterior abdominal segments; a row of 4–12 on posterior margin

[3] Figure is largely the work of Mrs. Julia Z. Iltis and was originally prepared for use by Professor McKenzie. Some additional details were added to Mrs. Iltis' figure by me. I am indebted to Professor McKenzie for allowing me to use this figure.

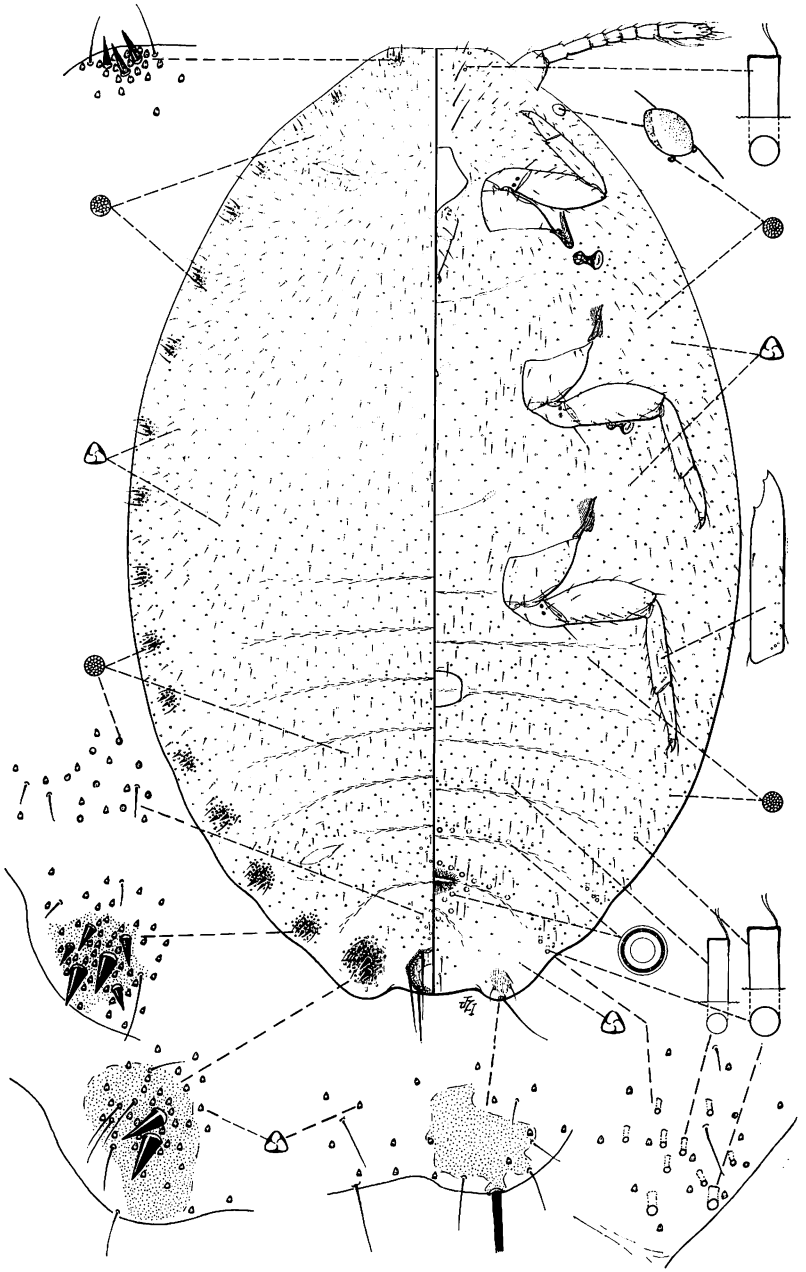

FIGURE 3. *Dysmicoccus mackenziei,* new species, dorsal and ventral aspects and details.

of segment 6, 10–20 along anterior margin of vulva on segment 7, and 8–14 behind vulva on segments 8 and 9; a total of 25–40 multilocular pores in available specimens. Trilocular pores moderately densely scattered over venter; interspersed with a few small discoidal pores 2–3 μ diameter. Dorsum sparsely clothed with short, fine setae mostly 10–16 μ in length, up to about 28 μ long on posterior segments around vulva; longer setae on venter of head anterior to mouthparts up to about 65 μ long.

Male. Unknown.

Described from 5 slide-mounted specimens. Holotype and 1 paratype on two slides: Temple City, California, 12–V–1961, L. Johnson, collector, on *Tillandsia punctulata;* 3 paratypes on 3 slides: Culver City, California, originally from Mexico, 15–III–1960, L. R. Gillogly and A. Beresford collrs., on *Vriesea* sp. Holotype in collection of University of California, Davis; paratypes in University of Hawaii, Honolulu; U.S. National Museum; State Department of Agriculture, Sacramento, California.

Dysmicoccus mackenziei appears to be most closely allied to *D. neobrevipes* but may be separated from the latter by its shorter, less robust appendages, the presence of micropores on the hind coxae and trochanters, less numerous ventral tubular ducts, and the differently shaped sclerotized area on the venter of each anal lobe. In *D. neobrevipes* this sclerotized area is about twice as long as broad, whereas in *D. mackenziei* it is only slightly narrower than long.

This species is named in honor of Professor Howard McKenzie of the University of California at Davis, in recognition of his many valuable contributions to the study of the Coccoidea.

7. Dysmicoccus alazon Williams.

Dysmicoccus alazon Williams, 1960, BULL. ENT. RESEARCH 51(2):239, fig. 1.

This species was described from specimens collected in the Canary Islands, and from a specimen taken from imported bananas in England and Egypt. It is apparently a banana pest of considerable importance in the Canary Islands. I have examined specimens from that host collected by A. Vilardebo at several localities in the Canary group, and it seems probable that the banana-infesting mealybug of the Canary group, discussed by Vilardebo (1962) under the name of *Pseudococcus comstocki* (Kuwana), is actually this species.

In the *D. alazon* specimens examined, there were always one or two small discoidal pores of the type found in *D. brevipes* about each eye, either on the eye margin or a short distance away from the eye. Similar pores were also found on the dorsal derm of the posterior abdominal segments and on the venter of the posterior abdominal segments, particularly in the area surrounding the vulva. These pores ranged from about 3 to 5 μ diameter.

The presence of discoidal pores in *D. alazon* suggests strongly that the species may be of American origin. Possibly it was introduced to the Canary Islands from somewhere in Central or South America.

The presence of sperm bundles within bodies of female *D. alazon* specimens from the Canary Islands which I have studied is fairly conclusive proof that the species is bisexual. Unfortunately, no adult males have been available.

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